

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 00/00494

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04Q 7/36

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, WPI, PAJ, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 9839939 A2 (TELEFONAKTIEBOLAGET LM ERICSSON), 11 Sept 1998 (11.09.98), page 4, line 21 - page 5, line 13; page 10, line 2 - line 7 --	1-24
A	EP 0866628 A2 (AT&T CORP.), 23 Sept 1998 (23.09.98), abstract --	1-24
A	WO 9809466 A1 (TELEFONAKTIEBOLAGET LM ERICSSON), 5 March 1998 (05.03.98), abstract --	1-24
A	US 5247701 A (R.A. COMROE ET AL), 21 Sept 1993 (21.09.93), column 1, line 56 - column 3, line 33 -- -----	1-24

☐ Further documents are listed in the continuation of Box C.
 ☒ See patent family annex.

<ul style="list-style-type: none"> • Special categories of cited documents "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed 	<ul style="list-style-type: none"> "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family
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Date of the actual completion of the international search

Date of mailing of the international search report

1 Sept 2000

11 -09- 2000

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INTERNATIONAL SEARCH REPORT
Information on patent family members

08/05/00

International application No.
PCT/FI 00/00494

Patent document cited in search report			Publication date	Patent family member(s)		Publication date
WO	9839939	A2	11/09/98	AU	6641398 A	22/09/98
				EP	0965243 A	22/12/99

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				CN	1201356 A	09/12/98
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				US	5884145 A	16/03/99

US	5247701	A	21/09/93	NONE		

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
14 December 2000 (14.12.2000)

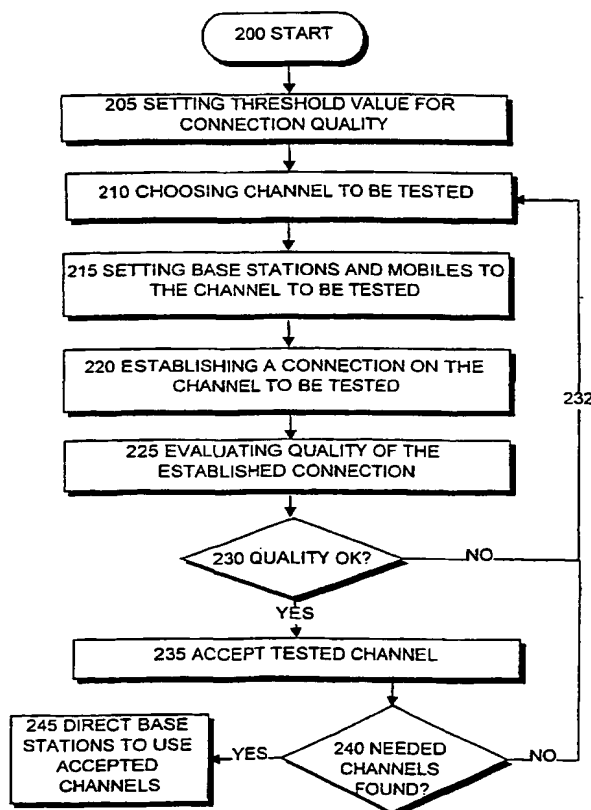
PCT

(10) International Publication Number
WO 00/76242 A1

- (51) International Patent Classification⁷: **H04Q 7/36**
- (21) International Application Number: **PCT/FI00/00494**
- (22) International Filing Date: **2 June 2000 (02.06.2000)**
- (25) Filing Language: **English**
- (26) Publication Language: **English**
- (30) Priority Data:
991285 **4 June 1999 (04.06.1999)** **FI**
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- (81) Designated States (national): **AE, AG, AL, AM, AT, AT (utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, CZ (utility model), DE, DE (utility model), DK, DK (utility model), DM, DZ, EE, EE (utility model), ES, FI, FI (utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KR (utility model), KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (utility model), SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.**
- (84) Designated States (regional): **ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE,**

[Continued on next page]

(54) Title: **METHOD FOR CHANNEL CONFIGURATION OF CELLULAR RADIO NETWORK, AND CELLULAR RADIO NETWORK**



(57) Abstract: A method for performing channel configuration in a cellular radio network for office use located in the operating area of a macro cell network, and a cellular radio network employing the method. In the method, (210) a logical control channel to be transmitted on a physical channel of a macro cell in the macro cell network is selected as the channel to be tested; (215) a base station of the cellular radio network for office use and terminals in the coverage area of the base stations in the cellular radio network for office use are directed to use the channel to be tested; (220) a connection is established by remote control between two or more terminals through the serving base stations on the channel being tested, and a measurement report is made concerning the quality of the connection; (232) the next control channel of a macro cell in the macro cell network is selected for testing until all control channels of the desired macro cells have been tested; (235) the channels whose use guarantees the best range in the cellular radio network for office use are decided on based on the measurement reports; (245) the base stations of the cellular radio network for office use are directed to use the channels guaranteeing the best range.

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IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Published:

— *With international search report.*

METHOD FOR CHANNEL CONFIGURATION OF CELLULAR RADIO NETWORK, AND CELLULAR RADIO NETWORK

FIELD OF THE INVENTION

The invention relates to a method for performing channel
5 configuration of base stations in a cellular radio network intended for office
environments, and an apparatus implementing the method.

BACKGROUND OF THE INVENTION

In a cellular radio network system, the size of cells may vary
according to the predicted traffic amount of an area, for instance. In a sparsely
10 populated area, the cells often are large macro cells, whereas in population
centres, the reuse of frequencies must be more efficient, which aim is reached
by reducing the size of cells, i.e. by using micro or pico cells. A micro cell
covers a multi-storey office building, for instance, or a section of a street,
whereas a pico cell covers an area of a few offices inside a building, for
15 instance. The diameter of a pico cell is typically from a few metres to a few
dozen metres, while the transmission power level of the base station is a few
dozen or hundred milliwatts, the size of a micro cell is in the range of 10 to 400
metres, and macro cells may be several kilometres in size, while the
transmission power level is dozens of watts.

20 In practise, the structure of cellular radio networks in population
centres are often such that a network formed by macro cells, such as a GSM
network (890 to 915 MHz in uplink direction and 935 to 960 MHz in downlink
direction), uses a different frequency band than a micro cell network, such as
a DCS network (1710 to 1785 MHz in uplink direction and 1805 to 1880 MHz
25 in downlink direction), whereby the traffic of one network does not cause
interference to that of the other.

Frequency planning becomes, however, more complicated if
networks using the same frequency range have overlapping coverage areas
having different cell sizes. Such a situation arises, for instance, when office
30 base station networks comprising micro or pico cells and operating on GSM
frequencies operate on the coverage area of a GSM network comprising
macro cells and operating in a densely populated area. One solution to using
frequencies in such a situation is to allocate a certain frequency range to the
macro cell network and another to the micro cell network from the frequency
35 band allocated to the GSM network. Alternatively, the micro cell network can

be implemented in such a manner that the channels it requires are dynamically borrowed from temporarily unused channels of the macro cell network. With respect to the capacity of the macro cell network, neither solution leads to a satisfactory result.

5 The frequency planning of a micro cell network can also be implemented using fixed channel allocation (FCA) and the same frequency space with the macro cell network, whereby the operation of the micro cell network must be ensured by careful frequency planning so as to prevent the macro cell network which has a higher transmission power level from causing
10 interference to the traffic of the micro cell network. Especially in situations where changes are made to the frequency usage of the macro cell network, the operation of the micro cell network must be ensured by a fast re-planning and re-selection of frequencies and a network operation testing combined to them. Today, the testing of the frequency set to be used is, in practice, done
15 manually by measurement personnel. The drawback is that the testing is slow and laborious, for instance in measurements done at night or repeated regularly.

BRIEF DESCRIPTION OF THE INVENTION

It is thus the object of the invention to implement a method and an
20 apparatus implementing the method so as to solve the above problems. This is achieved by the method disclosed in the following. The method in question is a method for performing channel configuration in a cellular radio network for office use located in the operating area of a macro cell network. In the method: a logical control channel to be transmitted on a physical channel of a macro
25 cell in the macro cell network is selected as the channel to be tested; the base station of the cellular radio network for office use and the terminals in the coverage area of the base stations in the cellular radio network for office use are directed to use the channel to be tested; a connection is established by remote control between two or more terminals through the serving base
30 stations on the tested channel and a measurement report is made concerning the quality of the connection; the next control channel of a macro cell in the macro cell network is selected for testing until all control channels of the desired macro cells have been tested; the channels whose use guarantees the best range in the cellular radio network for office use are decided on based on

the measurement reports; the base stations of the cellular radio network for office use are directed to use the channels guaranteeing the best range.

The invention also relates to a cellular radio network comprising one or more macro cell base stations, each coverage area being a macro cell and the macro cells forming a macro cell network; a cellular radio network for office use operating in the operating area of the macro cell network, which cellular radio network for office use comprises at least one base station and at least one terminal in radio connection with the base station. The cellular radio network also comprises a controller co-ordinating channel configuration, which controller comprises means for selecting as the channel to be tested a logical control channel to be transmitted on a physical channel of a macro cell, means for directing a base station of the cellular radio network for office use to use the channel to be tested, means for establishing by remote control a connection between two or more terminals through base stations serving the terminals on the channel to be tested, means for making a measurement report concerning the quality of the connection, means for selecting the next macro cell control channel for testing until all control channels of the desired macro cells have been tested, means for deciding on the basis of the measurement reports the channels whose use guarantees the best range in the cellular radio network for office use, and means for directing the base stations to use the channels guaranteeing the best range.

Preferred embodiments of the invention are set forth in the dependent claims.

The invention is based on the idea that the channels used in a cellular radio network for office use using the same channel space and operating in the operating area of a macro cell network are found by utilizing the continuous transmission on the control channels of the macro cell network. The method of the invention and the apparatus employing the invention makes it possible to automate the channel configuration of a cellular radio network for office use.

The method and system of the invention provide several advantages. Since in the method of the invention channel configuration is performed automatically by means of a separate application, the configuration can be performed during the night, for instance, before any changes made to the macro cell or weekly to ensure the operation of the network. Automatic selection of optimal channels by means of computers is quite fast and less

susceptible to errors than a manual configuration. The method and apparatus of the invention thus ensure the operation of a cellular radio network for office use in a situation where macro and micro cell networks use the same channel space.

5 BRIEF DESCRIPTION OF THE FIGURES

In the following, the invention will be described by means of preferred embodiments with reference to the attached drawings in which

Figure 1 shows a cellular radio network having both macro and micro cells,

10 Figure 2 is a flow chart illustrating a solution of the invention for finding frequencies in a cellular radio network for office use,

Figure 3 shows a preferred embodiment of a solution of the invention for finding channels for a cellular radio network for office use in the operating area of a macro cell network,

15 Figure 4 shows a cellular radio network for office use of the invention.

DETAILED DESCRIPTION OF THE INVENTION

In the following, the invention will be described in a GSM cellular radio network employing TDMA (time division multiple access) without, however, being limited to such a network. Thus in the described example, a physical channel refers to a frequency/time-slot combination, but in other types of systems, a physical channel can be implemented in another manner, for instance in a CDMA (code division multiple access) system as a frequency/spreading code combination. The solution of the invention can also be implemented in a hybrid system employing several multiple access methods simultaneously. The described cellular radio network for office use can be a normal cellular radio network in structure as shown in Figure 4, or it can be implemented so that the base stations are connected to each other through a local area network of the office. In such a case, the base station controller resides in the same local area network and is connected through an interface to a data network, such as an IP network. Even though the following describes the invention with reference to a cellular radio network operating in an office environment, it is clear that the solution of the invention for performing channel configuration can also be implemented in factories, temporary camping environments or corresponding cellular radio networks

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made up of pico or micro cells operating in the operating area of a macro cell network.

Figure 1 shows a cellular radio network comprising macro cells 102, each transmitting to three sectors 104 and divided from each other by dashed lines in the cells 102. Cell groups 106 comprising seven cells have been formed of the macro cells 102, the cell groups being outlined by a thicker line in Figure 1. Figure 1 also shows a group of micro cells 110 in the cellular radio network, the micro cells being numbered from 10 to 14.

The macro cell network shown in Figure 1 comprises cells 102 having three sectors, and frequencies a, b and c, on which the transmission to the various sectors 104 takes place, are marked in each cell. The cells 102 are shown as hexagons, which illustrates the theoretical coverage area of the base station of the cell. In practice, the coverage area of the cells is not necessarily a hexagon, but the size of the cell depends decidedly on the contour of the terrain and the existence of buildings, for instance. In practice, cells overlap and are partly on top of each other to achieve as good as possible a range. Depending on the required capacity, the letters a, b and c of the cell sectors can also be thought to describe frequency groups comprising several frequencies instead of individual frequencies. Cell groups 106 to 108 comprising seven cells 102 have been formed of the macro cells 102, the cell groups being outlined by a thicker line in Figure 1. The cells of the cell group 106 up on the left transmit above and to the right on frequency range 4a, to the right and below on frequency 4b, and to the left frequency range 4c. In the adjacent cell groups 107 to 108, the transmission directions have been turned 120 degrees so that the cell group 107 transmits to the left on frequency/frequency range 6a and the cell group 108 transmits below to the right on frequency/frequency range 3a.

By way of example, a group of micro cells 110, numbered 10 to 14 and whose frequency ranges are shown in table 1, are depicted in Figure 1 hierarchically with the macro cells described above. The table shows that the use of frequencies of the micro cells is implemented so that the interference caused by the macro cell network below to the micro cell network remains at minimum. Figure 1 and table 1 show that if changes are made to the use of frequencies in the macro cell network, the micro or pico cell network must adapt to these changes in such a manner that new frequencies that do not suffer from interference from the macro cells are found for the micro cells.

Micro cell	Frequency group
10	3A, 3C
11	2B, 2C
12	6A, 6B
13	6B, 6C
14	7A, 7B

Table 1. Frequency ranges used by micro cells

5 Figure 2 shows a method of the invention for finding and testing
pico/micro cell network channels. Even though in Figure 2, channels are
referred to on a general level, the following illustrates the invention in a GSM
cellular radio network employing TDMA, and a channel refers to a
frequency/time-slot combination. In the start step 200 of the method, the
10 frequencies in the macro cell network have been changed or a periodic, for
instance weekly, search for best frequencies is being made. A threshold value,
such as a bit error rate (BER), is set in method block 205 for calls to be made
in later method blocks, and the quality of calls undershooting the threshold and
consequently, the used channel can be accepted. In addition to the bit error,
15 the call quality can also be evaluated on the basis of a signal interference rate
(SIR), carrier interference rate (CIR), reception power or any other known
quality measurement method. If the threshold for the call quality is exceeded,
the interference caused by the macro cell network is considered to be too high
for the used channel, and it as well as the used frequency are rejected.

20 The frequency to be tested is selected in method block 210, which
frequency belongs to a predefined frequency group, for instance, from which
the micro cell network base stations can take frequencies for their use. In a
preferred embodiment of the invention, the frequency to be tested is a BCCH
(broadcast control channel) frequency of a GSM cellular radio network
25 comprising macro cells, i.e. a physical frequency on which the cellular radio
network transmits information on a logical BCCH channel to terminals. It is
advantageous to use a BCCH in measurements of the invention, because said
control channel has continuous traffic in the macro cell network, as the base
station transmits information on the cell to the terminals in a point-to-multipoint
30 manner. Because transmission on the BCCH channel is continuous, it is

possible to perform measurements at night. On traffic channels, the measurements would not give realistic results since the amount of traffic is minimal. Network management of the micro cell network being measured and the surrounding macro cell network is preferably performed from one and the same location and with the same network management system, whereby the network management system knows the BCCH frequencies of all macro cells surrounding the micro cell network, and of the frequencies, at least the one that is the best and has the least interference is according to the invention selected for the micro cell network. Managing both networks with the same network management system also provides the advantage that the network management system knows the macro cell control channels in which the traffic volume varies strongly and which thus are possibly disturbed, and consequently, it knows not to test or select them for use in the office base station network.

The method steps from step 210 to 240 are repeated in order to go through all frequencies in the frequency group and to select the best of them for the use of the base stations or alternatively in order to end the search for frequencies when a sufficient number of good frequencies that exceed the threshold values are found. In a preferred embodiment, the best BCCH frequency is found for the office network from those of the surrounding macro cells. In method step 215, the base stations of the micro cell network and the terminals in radio connection with the base stations are set to use the frequency to be tested. Next in step 220, a call connection is set up between the terminals, whereby a radio connection is established from the terminals to the base stations serving them, or to one base station if both terminals are in the same cell. The terminal transmits a measurement report on the quality of the connection between the terminal and the base station to the base station which forwards it to the network management system. In a preferred embodiment, the micro and macro cells are managed by the same network management system and the BCCH channels of the networks are synchronised with each other. When calls are then made in the micro cell network on a BCCH frequency, it is known where in the frequency the BCCH channel is used and the call can be set up synchronised with said channel, thus making interference measurement relevant. In an alternative embodiment, if the macro and micro cell networks are not synchronised with each other, in a TDMA network a call is set up between the terminals in all

time-slots of the BCCH frequency being tested, because it is not certain that the macro and micro cell networks are synchronised with each other. In the situation described above, it is possible to either first make the call in all time-slots of the frequency being tested and then compare the quality information of all connections with the threshold value, or make the calls in such a manner that after each call made in a time-slot, the quality information is compared with the threshold value. Because all time-slots are tested, the macro cell BCCH channel and the channel being tested overlap at least partly and relevant information is obtained on how much interference the macro cell network causes to the micro cell network.

In method step 225, the collected quality information of connections is compared with the threshold values set in step 210, and on the basis of this comparison, a decision is made in method step 230 on whether the used frequency is sufficiently good to be used in a micro cell network in the vicinity of a macro cell network. If the frequency does not meet the requirements set by the threshold values, the routine returns through method step 232 to step 210 where a new frequency is selected for testing; in one embodiment, this is the BCCH frequency of another cell. If the frequency, especially if it is a BCCH channel used in establishing a connection, exceeds the pre-set threshold value, it is accepted in step 235, after which the routine moves to method step 240 in which a check is made to see if the required frequencies have been found for the base stations. In practice, one frequency is usually enough for an office network due to the low transmission power levels of the base stations and, therefore, the short ranges. If there is a need to have more frequencies, the routine returns to step 210 to select a new frequency for testing. Otherwise, the search for frequencies can be stopped in step 240, and the routine can move to method step 245 in which the office base stations are directed to use the best channels found by the method. It is obvious to a person skilled in the art that in the process described above, the threshold value used as a quality indicator can be suitably altered so that a required number of frequencies are found. If during the first round of going through the pre-set frequency group, for instance, not enough frequencies are found, the threshold value, such as the bit error ratio, can be lowered and a new round of steps can be performed, in which case more frequencies meet the set threshold value.

In the following, the invention will be described by means of Figure 3 which shows a macro cell network comprising base stations 302A to 302G. To illustrate the invention, a channel group has been allocated for each macro cell base station 302A to 302G in the figure, and the base station has a radio connection with the terminals in the coverage area of the base station on these channels. In the figure, each macro cell base station 302A to 302G has a marked control channel CH1 to CH7 on which the macro cell base station signals information on the cell to the terminals within the area of the cell. An office network 300 comprising office base stations 304A to 304D is located in the operating area of the macro cell network. According to the method shown in Figure 2, the best channels are searched for the office network 300 from the control channels of the surrounding macro cell network. The search for a good channel can, for instance, be started by selecting as the first channel the control channel CH1 of the base station 302A. If the connection established on the control channel exceeds the quality criteria set for it, it is selected for use in the office network. If a TDMA network were used, all time-slots of the frequency comprising the control channel (e.g. a BCCH channel) would then be selected for use in the office network. With reference to Figure 3, when the control channel CH1 has been tested, the base stations of the office network are set on the control channel CH2 of the next macro cell base station 302B, and the next connection is established on it between the terminals within the coverage area of the office network. All or a part of the control channels in the surrounding macro cell network are gone through in this manner. In the example in Figure 3, the macro cell network uses 7 control channels which would then all be tested in this manner. In the example in the figure, the base stations 302B and 302D are located furthest away from the office network and would most likely produce the best measurement results with minimum interference on calls made on the control channels, and the channels CH2 and CH4 would then be selected for use in the office network.

Figure 4 shows the essential parts of the infrastructure of a cellular radio network for office use of the invention comprising a network management system 414, a data network 402, control means 404, a terminal 406, a base station 304, a base station controller 410 and a channel search application 412. It is obvious to a person skilled in the art that a cellular radio network also comprises other components and that the figure only shows the elements essential for the invention. The network management system 414

builds, manages and maintains the cellular radio network. Building the network refers here to defining the base stations 304 as parts of the cellular radio network and configuring them so as to enable communication between the terminals 406 through them. The network management system 414 initiates the quality measurements on connections between the terminals 406 and the base stations 304 through the data network 402 and the terminal controller 404. In an embodiment, the terminals are connected with a serial cable, for instance, to the terminal controller which in an embodiment is a computer. In another embodiment, the terminals are not conventional subscriber terminals, but especially arranged to make the measurements, so as to make their management possible by the network management system through the data network and the terminal controller. The terminals 406 and the terminal controller 404 are preferably fixed to the office environment to make it possible to perform measurements weekly, for instance.

The network management system 414 also receives the measurement reports on the connection quality between the terminals 406 and the base stations 304, and the measurement reports are sent from the terminals 406 to the base stations 304 from which they are forwarded to the network management system 414 through the base station controller 410. Information between the network management system 414 and the terminal controller 404 is transmitted in the data network 402 which most preferably is an IP network. The use of a data network between the network management system and the terminal controller makes even great physical distances possible, thus making it possible to remote operate office networks.

The search for frequencies for cellular radio networks for office use is co-ordinated by the controller 412 which controls the method steps described in Figure 2. It is not essential for the invention whether the controller 412 is separate from the network management system, as shown in Figure 4, or whether it is a part of the network management system 414. Most preferably, the controller 412 is, however, configured in such a manner that it is a part of the network management system, and all network management system services and interfaces can be used directly from the application. In Figure 4, a threshold value is first set for the controller 412 to evaluate the quality of the connections between the terminals 406 and the base stations 304. Before iterating the frequencies, the controller 412 commands the network management system 414 to switch the terminals 406 on through the

terminal controller 404 and starts the evaluation of the quality of the connections between the terminals 406 and the base stations 304 for the desired terminals 406. The controller 412 first selects the frequency to be tested and commands through the network management system 414 the base stations 304 to use this frequency. After directing the terminals 406 to use the frequency being tested, the controller 412 establishes a connection between the terminals 406 through the base stations 304 with the help of the terminal controller 404 and the data network 402. The measurement information on connection quality received by the network management system 414 is transmitted to the controller 412 which compares the measurement report with the set threshold value and determines whether the established connection and, consequently, the tested frequency is good enough. The method steps shown in Figure 2 are repeated under the control of the controller 412 until the required frequencies are found for the base stations 304 and the office base stations can be directed to use the found frequencies. Parts of the cellular radio network of the invention are preferably implemented by software run in a processor. Other parts can be implemented as hardware, for instance as an asic (application specific integrated circuit) or as a separate logic.

Even though the invention has been explained in the above with reference to examples in accordance with the accompanying drawings, it is obvious that the invention is not restricted to them but can be modified in many ways within the scope of the inventive idea disclosed in the attached claims.

CLAIMS

1. A method for performing channel configuration in a cellular radio network for office use located in the operating area of a macro cell network, **characterized by**

5 (210) selecting as the channel to be tested a logical control channel to be transmitted on the physical channel of a macro cell in the macro cell network,

(215) directing a base station of the cellular radio network for office use and terminals within the coverage area of the base stations of the cellular radio network for office use to use the channel to be tested,

10 (220) establishing by remote control a connection between two or more terminals through base stations serving the terminals on the channel being tested and making a measurement report on the quality of the connection,

15 (232) selecting as the channel to be tested the next control channel of a macro cell of the macro cell network until the control channels of all desired macro cells have been tested,

(235) determining on the basis of the measurement reports the channels whose use guarantees the best range in the cellular radio network for office use,

20 (245) directing the base stations of the cellular radio network for office use to use the channels guaranteeing the best range.

2. A method as claimed in claim 1, **characterized** in that the macro cell network and the cellular radio network for office use are controlled from the same location.

3. A method as claimed in claim 1, **characterized** in that the macro cell network and the cellular radio network for office use are synchronised with each other.

4. A method as claimed in claim 1, **characterized** in that a BCCH (broadcast control channel) is used as the control channel of the macro cell network.

30 5. A method as claimed in claim 1, **characterized** in that office base stations are used as the base stations of the cellular radio network for office use.

6. A method as claimed in claim 1, **characterized** that mobile phones are used as the terminals.

7. A method as claimed in claim 1, **characterized** in that a threshold value that the connection quality must meet is used in evaluating the quality of the connection.

8. A method as claimed in claim 7, **characterized** in that a bit error ratio is used as the threshold value.

9. A method as claimed as claim 1, **characterized** in that the terminal controller of the cellular radio network for office use, controlling the operation of the terminals, is controlled through a data network connected to the cellular radio network for office use.

10. A method as claimed in claim 1, **characterized** in that the channel configuration of the cellular radio network for office use is performed when building the cellular radio network for office use.

11. A method as claimed in claim 1, **characterized** in that the channel configuration of the cellular radio network for office use is performed at regular intervals.

12. A method as claimed in claim 1, **characterized** in that the physical channel of a macro cell is a time-slot of a radio frequency, and the logical control channel of the macro cell is directed to be transmitted at its time through each time-slot of said frequency.

13. A cellular radio network comprising one or more macro cell base stations (302A to 302G), each coverage area being a macro cell (102) and the macro cells (102) forming a macro cell network; a cellular radio network for office use (300) operating in the operating area of the macro cell network, which cellular radio network for office use comprises at least one base station (304A to 304D) and at least one terminal (406) in radio connection with the base station,

characterized in that

the cellular radio network also comprises a controller (412) co-ordinating the channel configuration, the controller (412) comprising means for selecting as the channel to be tested a logical control channel to be transmitted on a physical channel of the macro cell (102), means for directing the base station (304A to 304D) of the cellular radio network for office use (300) to use the channel to be tested, means for establishing by remote control a connection between two or more terminals (406) through the base

stations (304A to 304D) serving the terminals (406) on the channel being tested, means for making a measurement report on the connection quality, means for selecting as the channel to be tested the next control channel of a macro cell (102) until the control channels of all desired macro cells (102) have been tested, means for determining on the basis of the measurement reports the channels whose use guarantees the best range in the cellular radio network for office use (300), and means for directing the base stations (304A to 304D) to use the channels guaranteeing the best range.

14. A cellular radio network as claimed in claim 13, **characterized** in that the cellular radio network comprises a network management system for managing the macro cell network and the cellular radio network for office use.

15. A cellular radio network as claimed in claim 14, **characterized** in that the network management system is arranged to synchronise the cellular radio network and the macro cell network.

16. A cellular radio network as claimed in claim 13, **characterized** in that the control channel of the macro cell network is a BCCH (broadcast control channel).

17. A cellular radio network as claimed in claim 13, **characterized** in that the base stations of the cellular radio network for office use are office base stations.

18. A cellular radio network as claimed in claim 13, **characterized** in that the terminals are mobile phones.

19. A cellular radio network as claimed in claim 13, **characterized** in that the controller is arranged to use in evaluating the quality a threshold value that the connection quality must meet.

20. A cellular radio network as claimed in claim 19, **characterized** in that the controller is arranged to use a bit error ratio as the threshold value in evaluating the quality of the connection.

21. A cellular radio network as claimed in claim 13, **characterized** in that the cellular radio network comprises a data network for transmitting information in the cellular radio network and a terminal controller for controlling the terminals, and that the controller is arranged to control the terminal controller through the data network.

22. A cellular radio network as claimed in claim 13, **characterized** in that the controller comprises means for performing channel configuration when building the cellular radio network.

23. A cellular radio network as claimed in claim 13, **characterized** in that the controller comprises means for performing channel configuration of the cellular radio network at regular intervals.

24. A cellular radio network as claimed in claim 13, **characterized** in that the physical channel of the macro cell is a time-slot of a radio frequency, and the logical control channel is directed to be transmitted at its time through each time-slot of said frequency.

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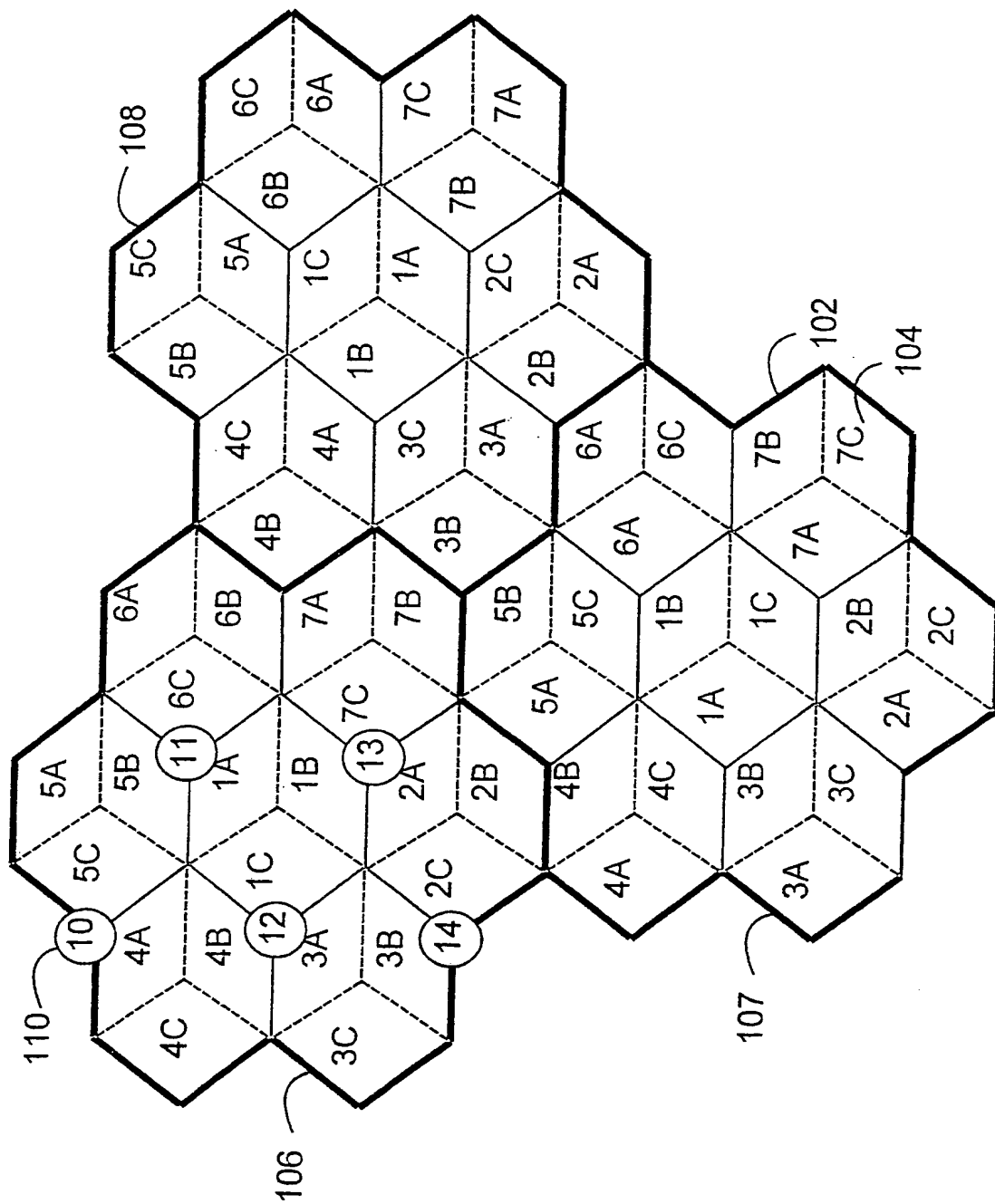


Fig. 1

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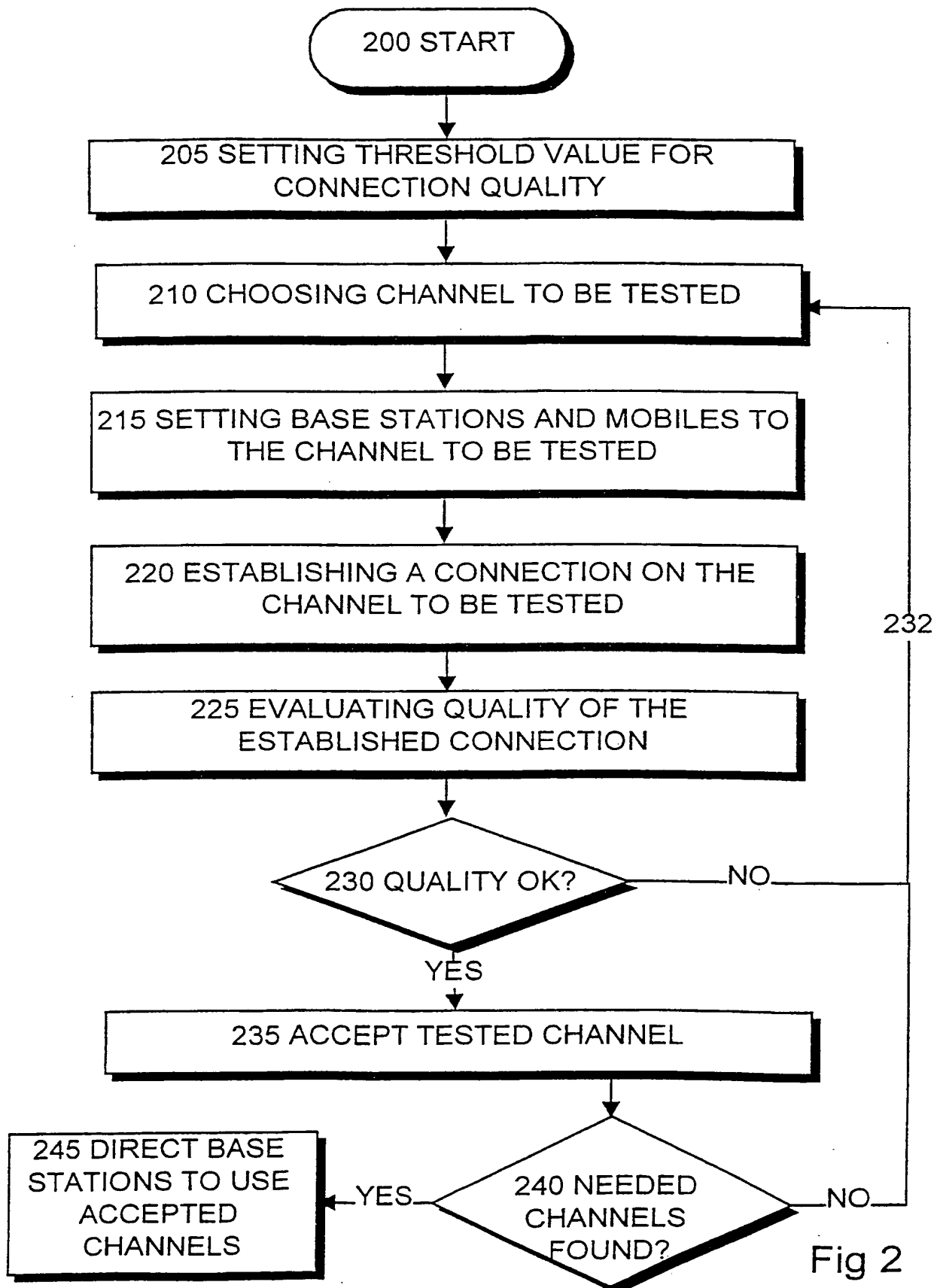


Fig 2

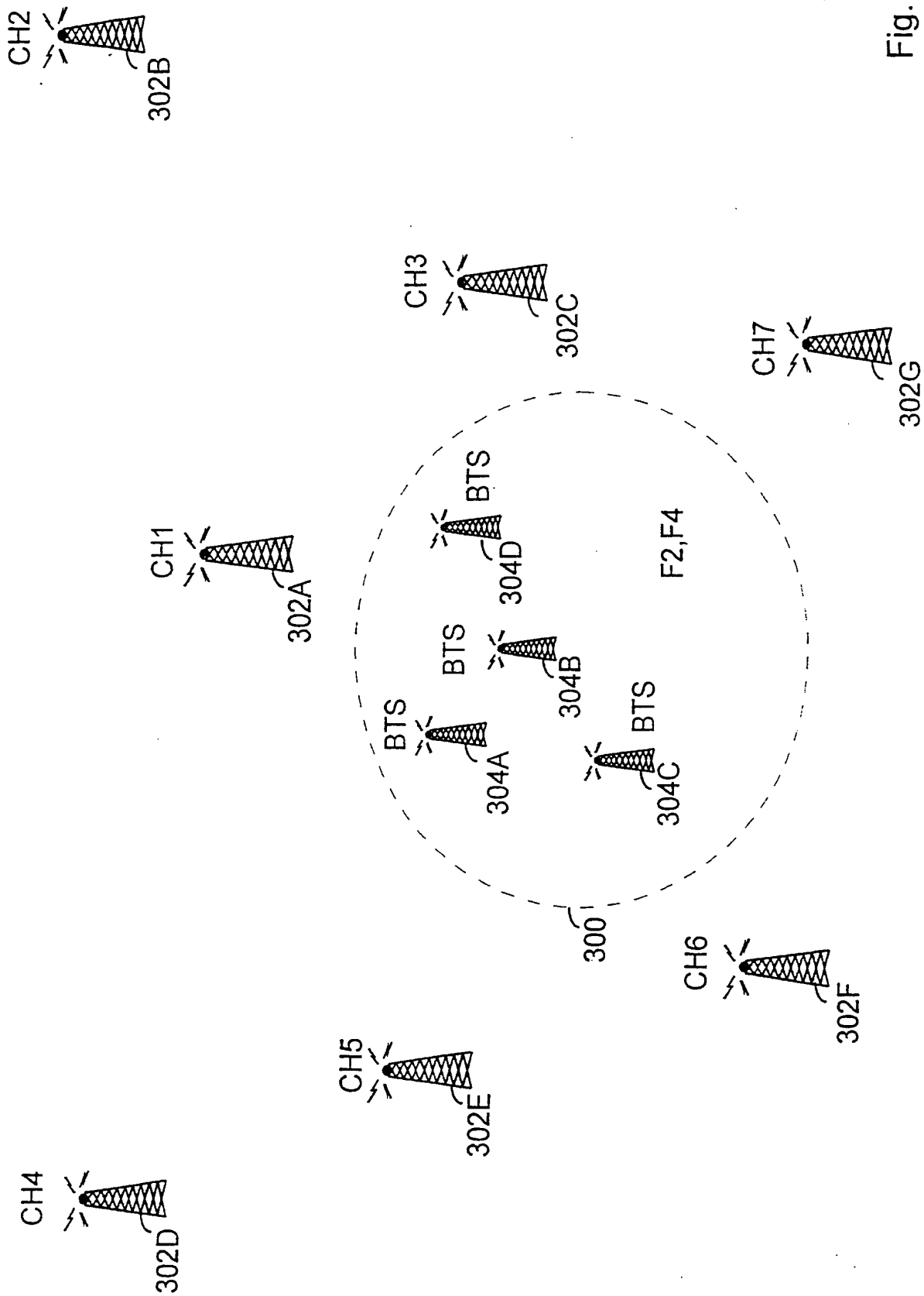


Fig. 3

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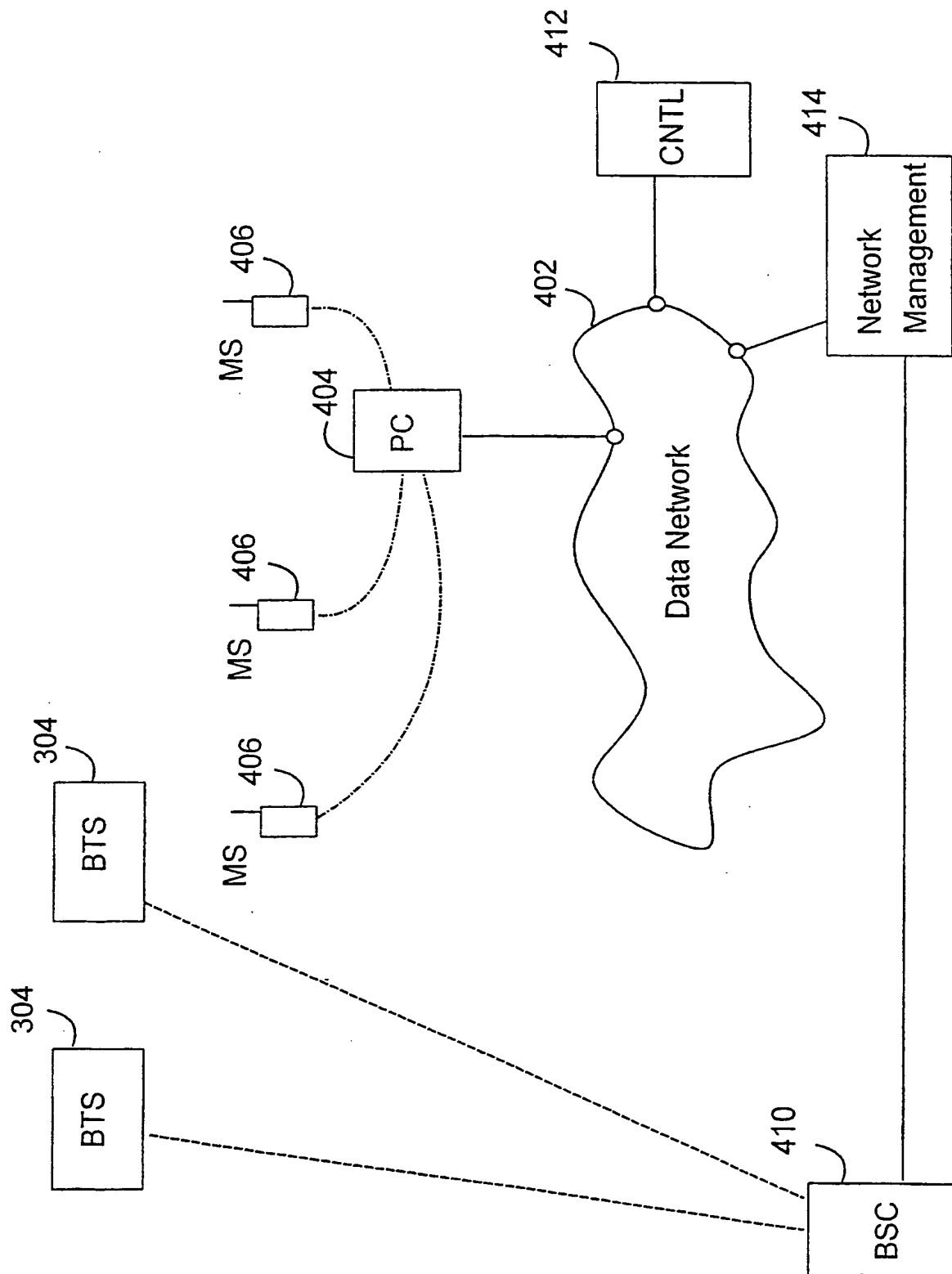


Fig. 4

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 00/00494

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04Q 7/36

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, WPI, PAJ, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 9839939 A2 (TELEFONAKTIEBOLAGET LM ERICSSON), 11 Sept 1998 (11.09.98), page 4, line 21 - page 5, line 13; page 10, line 2 - line 7 --	1-24
A	EP 0866628 A2 (AT&T CORP.), 23 Sept 1998 (23.09.98), abstract --	1-24
A	WO 9809466 A1 (TELEFONAKTIEBOLAGET LM ERICSSON), 5 March 1998 (05.03.98), abstract --	1-24
A	US 5247701 A (R.A. COMROE ET AL), 21 Sept 1993 (21.09.93), column 1, line 56 - column 3, line 33 -- -----	1-24

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

1 Sept 2000

Date of mailing of the international search report

11 -09- 2000

Name and mailing address of the ISA/

Swedish Patent Office

Box 5055, S-102 42 STOCKHOLM

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Authorized officer

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INTERNATIONAL SEARCH REPORT
Information on patent family members

08/05/00

International application No.
PCT/FI 00/00494

Patent document cited in search report			Publication date	Patent family member(s)		Publication date
WO	9839939	A2	11/09/98	AU	6641398 A	22/09/98
				EP	0965243 A	22/12/99
EP	0866628	A2	23/09/98	CA	2217288 A	19/09/98
				CN	1201356 A	09/12/98
				JP	10322761 A	04/12/98
				US	6052596 A	18/04/00
WO	9809466	A1	05/03/98	AU	3877397 A	19/03/98
				US	6009332 A	28/12/99
				US	5884145 A	16/03/99
US	5247701	A	21/09/93	NONE		

PATENT COOPERATION TREATY

PCT

NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and
Administrative Instructions, Section 422)

From the INTERNATIONAL BUREAU

To:

KOLSTER OY AB
Iso Roobertinkatu 23
P.O. Box 148
FIN-00121 Helsinki
FINLANDE

RECEIVED
JUL 09 2001
Technology Center 2600

Date of mailing (day/month/year) 21 March 2001 (21.03.01)	IMPORTANT NOTIFICATION
Applicant's or agent's file reference T299013PC/nu	
International application No. PCT/FI00/00494	International filing date (day/month/year) 02 June 2000 (02.06.00)

1. The following indications appeared on record concerning:									
<input type="checkbox"/> the applicant	<input type="checkbox"/> the inventor <input checked="" type="checkbox"/> the agent <input type="checkbox"/> the common representative								
Name and Address PATENTTITOIMISTO TEKNOLOGIS KOLSTER OY c/o Kolster OY AB Iso Roobertinkatu 23 P.O. Box 148 FIN-00121 Helsinki Finland	<table border="1"> <tr> <td>State of Nationality</td> <td>State of Residence</td> </tr> <tr> <td colspan="2">Telephone No. + 358 9 618 821</td> </tr> <tr> <td colspan="2">Facsimile No. + 358 9 602 244</td> </tr> <tr> <td colspan="2">Teleprinter No.</td> </tr> </table>	State of Nationality	State of Residence	Telephone No. + 358 9 618 821		Facsimile No. + 358 9 602 244		Teleprinter No.	
State of Nationality	State of Residence								
Telephone No. + 358 9 618 821									
Facsimile No. + 358 9 602 244									
Teleprinter No.									
2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:									
<input type="checkbox"/> the person	<input checked="" type="checkbox"/> the name <input type="checkbox"/> the address <input type="checkbox"/> the nationality <input type="checkbox"/> the residence								
Name and Address KOLSTER OY AB Iso Roobertinkatu 23 P.O. Box 148 FIN-00121 Helsinki Finland	<table border="1"> <tr> <td>State of Nationality</td> <td>State of Residence</td> </tr> <tr> <td colspan="2">Telephone No. + 358 9 618 821</td> </tr> <tr> <td colspan="2">Facsimile No. + 358 9 602 244</td> </tr> <tr> <td colspan="2">Teleprinter No.</td> </tr> </table>	State of Nationality	State of Residence	Telephone No. + 358 9 618 821		Facsimile No. + 358 9 602 244		Teleprinter No.	
State of Nationality	State of Residence								
Telephone No. + 358 9 618 821									
Facsimile No. + 358 9 602 244									
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3. Further observations, if necessary:									
4. A copy of this notification has been sent to:									
<input checked="" type="checkbox"/> the receiving Office	<input checked="" type="checkbox"/> the designated Offices concerned								
<input type="checkbox"/> the International Searching Authority	<input type="checkbox"/> the elected Offices concerned								
<input type="checkbox"/> the International Preliminary Examining Authority	<input type="checkbox"/> other:								

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer C. Cupello
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

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T299013PC/nu

PCT REQUEST

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0 0-1	For receiving Office use only International Application No.	PCT/FI 0 0 / 0 0 4 9 4
0-2	International Filing Date	0 2 JUN 2000 (0 2 -06- 2000)
0-3	Name of receiving Office and "PCT International Application"	The Finnish Patent Office PCT International Application
0-4 0-4-1	Form - PCT/RO/101 PCT Request Prepared using	PCT-EASY Version 2.90 (updated 10.05.2000)
0-5	Petition The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty	
0-6	Receiving Office (specified by the applicant)	National Board of Patents and Registration (Finland) (RO/FI)
0-7	Applicant's or agent's file reference	T299013PC/nu
I	Title of invention	METHOD FOR CHANNEL CONFIGURATION OF CELLULAR RADIO NETWORK, AND CELLULAR RADIO NETWORK
II II-1 II-2 II-4 II-5	Applicant This person is: Applicant for Name Address:	applicant only all designated States except US NOKIA NETWORKS OY Keilalahdentie 4 FIN-02150 Espoo Finland
II-6 II-7	State of nationality State of residence	FI FI
III-1 III-1-1 III-1-2 III-1-4 III-1-5	Applicant and/or inventor This person is: Applicant for Name (LAST, First) Address:	applicant and inventor US only VÄISÄNEN, Veijo Luolakatu 4 A 17 FIN-33710 Tampere Finland
III-1-6 III-1-7	State of nationality State of residence	FI FI

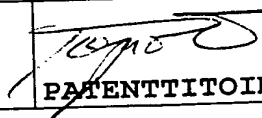
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IV-1	Agent or common representative; or address for correspondence The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:	agent
IV-1-1	Name	PATENTTITOIMISTO TEKNOPOLOIS KOLSTER OY
IV-1-2	Address:	C/O KOLSTER OY AB Iso Roobertinkatu 23 P.O. Box 148 FIN-00121 Helsinki Finland
IV-1-3	Telephone No.	+ 358 9 618 821
IV-1-4	Facsimile No.	+ 358 9 602 244
IV-1-5	e-mail	kolster@kolster.fi
V	Designation of States	
V-1	Regional Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	AP: GH GM KE LS MW MZ SD SL SZ TZ UG ZW and any other State which is a Contracting State of the Harare Protocol and of the PCT EA: AM AZ BY KG KZ MD RU TJ TM and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT EP: AT BE CH&LI CY DE DK ES FI FR GB GR IE IT LU MC NL PT SE and any other State which is a Contracting State of the European Patent Convention and of the PCT OA: BF BJ CF CG CI CM GA GN GW ML MR NE SN TD TG and any other State which is a member State of OAPI and a Contracting State of the PCT
V-2	National Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	AE AG AL AM AT (patent and utility model) AU AZ BA BB BG BR BY CA CH&LI CN CR CU CZ (patent and utility model) DE (patent and utility model) DK (patent and utility model) DM DZ EE (patent and utility model) ES FI (patent and utility model) GB GD GE GH GM HR HU ID IL IN IS JP KE KG KP KR (patent and utility model) KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX MZ NO NZ PL PT RO RU SD SE SG SI SK (patent and utility model) SL TJ TM TR TT TZ UA UG US UZ VN YU ZA ZW

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V-5	Precautionary Designation Statement In addition to the designations made under items V-1, V-2 and V-3, the applicant also makes under Rule 4.9(b) all designations which would be permitted under the PCT except any designation(s) of the State(s) indicated under item V-6 below. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit.		
V-6	Exclusion(s) from precautionary designations	NONE	
VI-1	Priority claim of earlier national application	04 June 1999 (04.06.1999)	
VI-1-1	Filing date	991285	
VI-1-2	Number	FI	
VI-1-3	Country		
VI-2	Priority document request The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) identified above as item(s):	VI-1	
VII-1	International Searching Authority Chosen	Swedish Patent Office (ISA/SE)	
VIII	Check list	number of sheets	electronic file(s) attached
VIII-1	Request	4	-
VIII-2	Description	11	-
VIII-3	Claims	4	-
VIII-4	Abstract	1	t299013p.txt
VIII-5	Drawings	4	-
VIII-7	TOTAL	24	
VIII-8	Accompanying items	paper document(s) attached	electronic file(s) attached
VIII-8	Fee calculation sheet	✓	-
VIII-9	Separate signed power of attorney	✓	-
VIII-10	Copy of general power of attorney	✓	-
VIII-16	PCT-EASY diskette	-	diskette
VIII-17	Other (specified):	Copy of Official Action	-
VIII-18	Figure of the drawings which should accompany the abstract	2	
VIII-19	Language of filing of the international application	English	
IX-1	Signature of applicant or agent	 Tapio Äkräs	
IX-1-1	Name	PATENTTITOIMISTO TEKNOPOLOIS KOLSTER OY	

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10-1	Date of actual receipt of the purported international application	02 JUN 2000	(02 -06- 2000)
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10-2	Drawings:	
10-2-1	Received	
10-2-2	Not received	
10-3	Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application	
10-4	Date of timely receipt of the required corrections under PCT Article 11(2)	
10-5	International Searching Authority	ISA/SE
10-6	Transmittal of search copy delayed until search fee is paid	

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11-1	Date of receipt of the record copy by the International Bureau	
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